

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
17 April 2003 (17.04.2003)

PCT

(10) International Publication Number  
WO 03/032666 A1

(51) International Patent Classification<sup>7</sup>: H04Q 7/32, H04B 7/26

(21) International Application Number: PCT/US02/31745

(22) International Filing Date: 4 October 2002 (04.10.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
09/974,587 9 October 2001 (09.10.2001) US

(71) Applicant: INTEL CORPORATION [US/US]; 2200 Mission College Boulevard, Santa Clara, CA 95052 (US).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

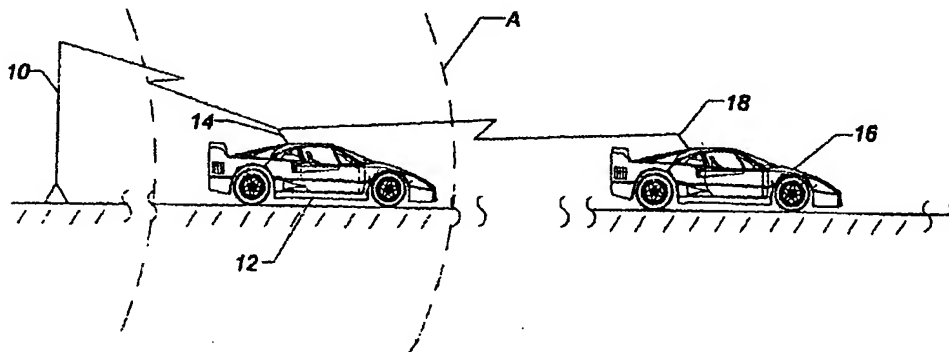
(72) Inventor: SILVESTER, Kelan; 19840 NW Metolius Drive, Portland, OR 97229 (US).

Published:  
— with international search report

(74) Agents: TROP, Timothy, N.; Trop, Pruner & Hu, P.C., Suite 100, 8554 Katy Freeway, Houston, TX 77024 et al. (US).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: MOBILE SIGNAL RELAY FOR CELLULAR TRANSMISSION IN REMOTE AREAS



(57) Abstract: A large number of vehicles (12) may be equipped with cellular repeaters (20). These repeaters (20) may receive signals from proximate towers (10) or proximate vehicles (16) and forward them on in order to complete communications that would not otherwise be possible. Thus, vehicles (16) that are attempting to make or receive cellular transmissions may have those transmissions completed via a mobile repeater in other vehicles (12). As a result, the range of existing cellular telephone systems may be extended without the need for an increased number of cellular towers.

WO 03/032666 A1

Mobile Signal Relay For  
Cellular Transmission In Remote Areas

Background

This invention relates generally to cellular communication systems and,  
5 particularly, to the use of cellular repeaters.

In a number of circumstances, cellular telephone users are frustrated by the lack of cellular telephone service. For example, when traveling along highways, the user may experience dropped calls because the user moves out of range of a sufficiently proximate cellular tower. In addition, in so-called pocket areas, users may experience the absence of  
10 cellular service because buildings or other geographical obstacles, such as mountains or valleys, mask communications with proximate towers.

Of course, one obvious solution is to increase the number of cellular towers. However, this approach comes with a number of disadvantages. The cellular towers and their maintenance may be expensive. In addition, many communities object to the  
15 presence of what are considered to be unsightly cellular towers.

Thus, it would be desirable to extend cellular service without increasing the number of cellular towers.

Brief Description of the Drawings

Figure 1 is a schematic depiction of one embodiment of the present invention; and  
20 Figure 2 is a block diagram in accordance with one embodiment of the present invention.

Detailed Description

Referring to Figure 1, a cellular user traveling in an automobile 16 may attempt to place a cellular phone call. However, in the illustrated example, the vehicle 16 is too far  
25 from the most proximate cellular tower 10 to establish communications. However, an intermediate vehicle 12, including a cellular repeater coupled to an antenna 14, is available. Thus, the outgoing transmission from the vehicle 16 may be received by the vehicle 12 and automatically retransmitted to the tower 10. Because the vehicle 12 is in range of the tower 10, the cellular call may be completed. The operator of the vehicle 12  
30 may have no idea that his vehicle and its repeater is being used to forward a telephone call

and may have no knowledge or access to the communication between the vehicle 16 and the tower 10.

If a large number of vehicles traveling on roads and highways are equipped with cellular repeaters, the range of existing cellular telephone systems may be extended. This may be accomplished without the need to increase the number of cellular towers. In effect then, each such vehicle becomes a mobile repeater. Whenever a repeater equipped vehicle happens to be in range of another vehicle that is not in range of any cellular tower, the repeater equipped vehicle acts to automatically forward incoming or outgoing communications. If the population of such repeaters is sufficient, the range of existing cellular phone systems may be greatly extended. Embodiments of the present invention may be applied in cellular telephone systems including those using Advanced Mobile Phone Service (AMPS), Code Division Multiple Access (CDMA), Time Division Multiple Access (TDMA), and Global System for Mobile Communications (GSM), as examples.

Cellular repeaters with relatively reasonable range may be made in sufficiently small form factors to be accommodated within passenger vehicles. Larger repeaters may be provided on large trucks that may extend the cellular system's range to an even greater degree. In some embodiments, the cellular repeaters may use existing radio technology in vehicles, such as existing AM/FM radios. In other words, the repeater may be incorporated with the existing automotive radio and may share components of such a radio.

Advantageously, the repeater does no signal processing so there is no way for cellular transmissions to be distorted, modified, recorded, intercepted, or the like. Thus, the repeater is advantageously simply a signal repeater.

Referring to Figure 2, a cellular repeater may include a pair of antennas 14a and 14b. Advantageously, the antennas 14a and 14b may be well isolated from one another. The antenna 14a may receive signals that are passed through the duplexer 22a, the isolator 24b, and an amplifier 26b, and then passed out through the duplexer 22b and through the antenna 14b. Similarly, incoming signals received by the antenna 14 may be passed through the isolator 24a and amplifier 26a before proceeding outwardly through the antenna 14a via the duplexer 22a. The isolators 24a and 24b may provide filtering in some embodiments. The isolators 22 and the amplifiers 26 may be coupled, as indicated, to the vehicle's existing battery power supply.

While the present invention has been described with respect to a limited number of embodiments, those skilled in the art will appreciate numerous modifications and variations therefrom. It is intended that the appended claims cover all such modifications and variations as fall within the true spirit and scope of this present invention.

5           What is claimed is:

1. A method comprising:  
providing cellular repeaters in a plurality of vehicles; and  
enabling those repeaters to receive cellular transmissions and to forward those transmissions between mobile users and proximate cellular towers.
- 5 2. The method of claim 1 including incorporating a cellular repeater into a vehicle radio.
3. The method of claim 1 including preventing the operator of a vehicle including a cellular repeater from intercepting a transmission to be forwarded.
4. The method of claim 1 including powering the repeater from a vehicle  
10 power supply.
5. The method of claim 1 including bi-directionally transmitting transmissions to and from cellular towers through said repeaters.
6. The method of claim 1 including bi-directionally transmitting transmissions to and from other mobile repeaters.
- 15 7. A cellular repeater comprising:  
an antenna to receive or transmit a cellular signal;  
an amplifier to amplify the cellular signal; and  
a connection to a vehicular power supply.
8. The repeater of claim 7 including a pair of antennas.
- 20 9. The repeater of claim 7 including a pair of antennas, each of said antennas connected to a duplexer.
10. The repeater of claim 9 including a pair of amplifiers, each coupled to amplify a signal for one of said antennas.

11. The repeater of claim 7 including a pair of isolators, each isolator associated with one of said amplifiers.
12. A method comprising:
  - installing a repeater in a plurality of vehicles;
  - coupling the repeater to an automotive electrical system; and
  - enabling the repeaters to receive and transmit cellular communications and to forward those communications to proximate cellular towers.
13. The method of claim 12 including incorporating a cellular repeater into a vehicle radio.
14. The method of claim 12 including preventing the operator of a vehicle including a cellular repeater from intercepting a transmission to be forwarded.
15. The method of claim 12 including powering the repeater from a vehicle power supply.
16. The method of claim 12 including bi-directionally transmitting transmissions to and from cellular towers through said repeaters.

1/1

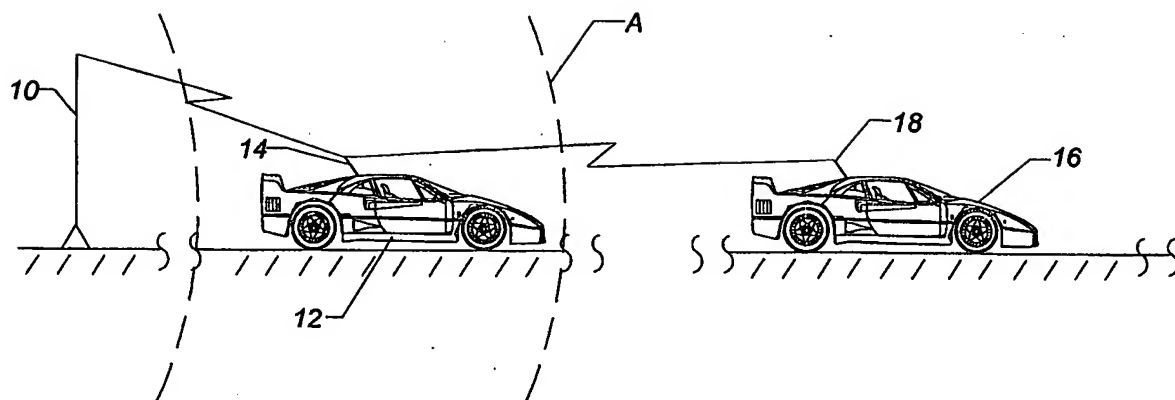


FIG. 1

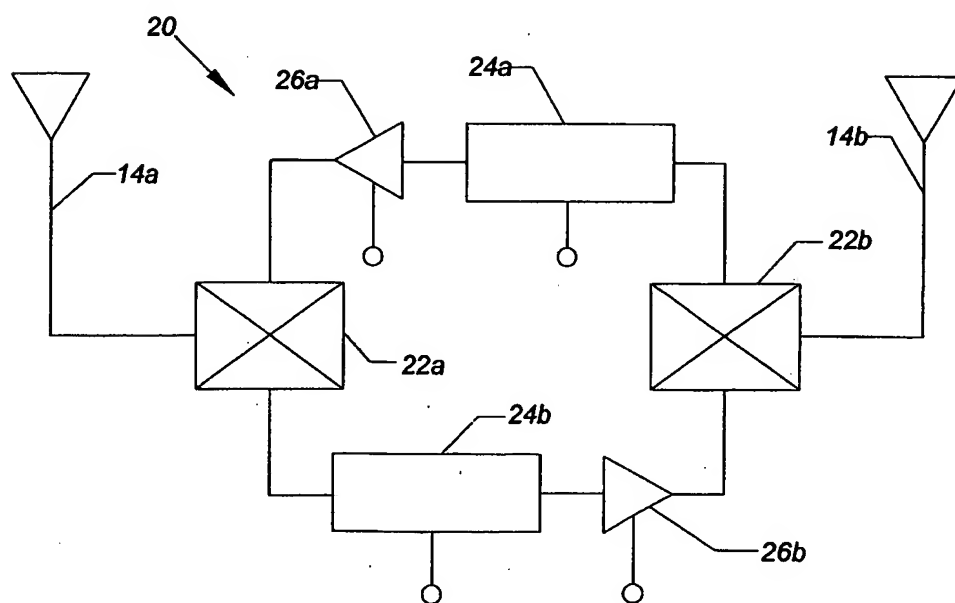


FIG. 2

## INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 02/31745

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 H04Q7/32 H04B7/26

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04Q H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 02 28134 A (AEROSAT CORP) 4 April 2002 (2002-04-04) abstract page 3, line 9 -page 4, line 10 figure 1 claims	1, 5, 6
X	US 5 530 909 A (SIMON GEORGES-HENRI ET AL) 25 June 1996 (1996-06-25)	1, 2, 4-6, 12, 13, 15, 16
Y	the whole document	3, 14
Y	DE 197 48 681 A (INNOTECH GMBH) 12 May 1999 (1999-05-12) abstract column 1, line 44 -column 2, line 7 column 4, line 65 -column 5, line 42 -/-	3, 14



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

## \* Special categories of cited documents:

\*A\* document defining the general state of the art which is not considered to be of particular relevance

\*E\* earlier document but published on or after the international filing date

\*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

\*O\* document referring to an oral disclosure, use, exhibition or other means

\*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\*A\* document member of the same patent family

Date of the actual completion of the international search

17 January 2003

Date of mailing of the international search report

24/01/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Dejonghe, O



## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 02/31745

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 89 04569 A (SUPERIOR ELECTRONIC DEV) 18 May 1989 (1989-05-18)	7-10
Y	figures 1,2	11
Y	WO 97 42720 A (GHASEMZADEH FARSHID ;JONSSON BO (SE); LG PRODUCTS AB (SE); ANDREAS) 13 November 1997 (1997-11-13). abstract page 1, line 12-18 figure 1	11
X	US 5 973 647 A (BARRETT MICHAEL J ET AL) 26 October 1999 (1999-10-26) column 3, line 52 -column 4, line 13	1,2,4-6
X	US 6 285 878 B1 (LAI JOSEPH) 4 September 2001 (2001-09-04) column 6, line 39-48 figure 7	7,8
X	DE 196 42 515 A (BOSCH GMBH ROBERT) 16 April 1998 (1998-04-16)  the whole document	1,2,4-6, 12,13, 15,16

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 02/31745

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 0228134	A	04-04-2002	AU 9313201 A WO 0228134 A2	08-04-2002 04-04-2002
US 5530909	A	25-06-1996	FR 2703537 A1 DE 69410333 D1 DE 69410333 T2 EP 0618704 A1	07-10-1994 25-06-1998 07-01-1999 05-10-1994
DE 19748681	A	12-05-1999	DE 19748681 A1 AU 2048499 A WO 9925135 A2	12-05-1999 31-05-1999 20-05-1999
WO 8904569	A	18-05-1989	AU 2628988 A WO 8904569 A1 ES 2013813 A6 ZA 8808495 A	01-06-1989 18-05-1989 01-06-1990 25-10-1989
WO 9742720	A	13-11-1997	SE 506571 C2 AT 228734 T AU 2797997 A DE 69717430 D1 EP 0894372 A1 SE 9601774 A WO 9742720 A1	12-01-1998 15-12-2002 26-11-1997 09-01-2003 03-02-1999 10-11-1997 13-11-1997
US 5973647	A	26-10-1999	NONE	
US 6285878	B1	04-09-2001	NONE	
DE 19642515	A	16-04-1998	DE 19642515 A1 CZ 9901280 A3 WO 9817073 A2 EP 0932992 A2 PL 332605 A1 SK 47499 A3	16-04-1998 15-09-1999 23-04-1998 04-08-1999 27-09-1999 14-08-2000